Various causes have, no doubt, contributed to this result; but the proof is positive that the introduction of science *has not interfered*, to say the least, with elementary education in the "three R's."

V. On the first introduction of the system there may be a certain amount of antagonistic feeling aroused amongst some head masters and mistresses. In Birmingham this was indeed to some small extent the case. Some head teachers feared that the demonstrator would prove a new inspector, who, having to discharge duties as a teacher, might unduly interfere with their own functions, and that some conflict of authority might occur. To the best of my knowledge, however, this feeling has entirely disappeared. The only complaints which I hear as Chairman of the School Management Committee, are when the experimental lessons are omitted at any school through any stress of examination work or accidental circumstance. The masters find that the science demonstrators render them valuable assistance and do a work which it is out of their own power to accomplish.

In order to apply the severest test to the peripatetic system, I applied to the head master of a large school, situated in one of the very poorest districts in Birmingham, and attended by children whose social surroundings are, as a rule, almost as unfavourable to intellectual development as they can possibly be. The school has accommodation for 416 boys, and an average attendance of about 350, 414 being sometimes present during the week.

The reply of the head master to my request that he would inform me of the results of the science teaching in his school, lifts the whole question out of the region of controversy.

Dartmouth Street Boys' Board School,
Birmingham, September 9, 1884.

Rev. Sir,—In reply to yours of this morning, I beg to make the following remarks:—

The results from the science lessons given in this school are very gratifying. I have seen results in a variety of ways both in and out of school.

The interest taken in these lessons, both by parents and boys, is surprising. Many a mother has, to my frequent knowledge, inconvenienced herself in her domestic duties on certain days when we have sent word for her boy to be present, as the science demonstrator was expected that morning. The day is well remembered by most of them, and eagerly looked forward to. The attendance in the uppermost class is wonderfully increased on the mornings these lessons are given.

The results in other subjects in those standards where science is taught are none the less satisfactory. A greater intelligence and thought are quickly discovered when we are dealing with the other subjects.

Teachers are more encouraged when brighter material to work with is placed in their hands.

Other important subjects have impressed me very much, viz. the desire of the boys after leaving school to continue to study some science subject at some of our science classes.

Older brothers, too, have been induced to go to science classes through seeing the growth of knowledge in those much younger than themselves.

Many persons who have reason to come in contact with the boys after leaving school, have expressed themselves in tones of great regret that such instruction was not given when they attended school.

I remain, Rev. Sir,
Your obedient servant,
Rev. Dr. Crosskey. T. H. PURCELL.

As a development of the systematic and experimental system of science training I have described—a system only rendered possible of adoption by the employment of the peripatetic method—a new kind of Board school has been opened in Birmingham, for the purpose of enabling the scientific work commenced in the elementary school to be continued by the more advanced scholars before they enter upon their respective employments in workshops and factories.

The arrangements of the peripatetic system will suffice until the sixth standard is passed; but special provision must be made for those lads who can remain a year or two longer at school, and whose future employments render the extension of their scientific training desirable. A large proportion of those who pass the sixth standard are obliged to earn their livings at once; for these various evening classes are available. But a certain number of working men can, by an effort, manage to exempt their children from toil, say for an extra two years.

The question therefore arises whether special provision cannot be made for scholars who must ultimately earn their living as working men, but whose parents can afford to keep them at school for two years after they have passed the sixth standard?

It is evident that for such scholars increased facilities for scientific study will have a peculiar, indeed almost an incalculable, importance.

They have been well grounded in the first principles of science and familiarised with the management of apparatus and the conduct of experiments during their school career. Their work in life will be largely increased, not only in pecuniary and mechanical, but in intellectual and moral value, by scientific knowledge.

To meet the wants of this class, a school has been opened as an experiment, in New Bridge Street, Birmingham, in premises belonging to the Chairman of the Board (Mr. George Dixon), who, at the cost of more than 2000*l.*, has adapted them for the purpose, and placed them rent free at the service of the Board.

The characteristics of this school are the following:—

I. It is especially intended for scholars who will have to become working men, but whose parents can keep them at school after they have passed the sixth standard, and the fee (3*d.* a week) is adapted to their means.

II. While a seventh standard school under the Code, the instruction given is largely scientific and technical; and a special staff of trained scientific men has been appointed. There is a special master for chemistry and metallurgy; another master for mechanics and physics; a drawing master; and a mathematical master; a highly qualified scientific man being placed at the head. Workshop instruction is provided, and includes a knowledge of the chief wood tools, and the properties of materials, while it supplements the mechanical drawing of the schoolroom, and is an aid to the study of theoretical mechanics.

III. The course of instruction is arranged to extend over two years. In the first year the scholars take ordinary standard work, together with mathematics, mechanics, drawing, chemistry, and workshop practice.

In the second year the study of mathematics will be continued, but it is intended that the scholars shall then specialise their studies in one of the following groups: (1) Chemistry and Metallurgy. (2) Mechanics and Machine Drawing. (3) Physics and Geometry.

The peculiarity of this scheme is that it is not an attempt to benefit a few picked scholars or to provide a higher-grade school for those able to pay high fees, but that it is a continuation of the science training given by means of the peripatetic method in every ordinary elementary school under the Board.

It has already been made evident that a large capacity for scientific investigation—amounting, I believe, almost to a special genius for the study of science—exists among our English people, which has never yet received its full and fair development. The country is undoubtedly awakening to the necessity of making better provision for the study of science, in order that our manufacturers may hold their own in the markets of the world. Other and higher blessings will follow in its train. Labour, in being made intelligent, will cease to be so loveless as it often is, and the lives of toiling thousands will be filled with larger interests, guided by finer tastes, and enriched with nobler joys.

THE ASSOCIATION OF GERMAN NATURALISTS AND PHYSICIANS

THE annual gathering of this influential Society was held this year at Magdeburg during the week ending September 23, simultaneously with the yearly meetings of the German Botanical and Meteorological Associations. The proceedings were opened by the President, Dr. Gaehde, whose address was followed with a few appropriate remarks by Prof. Hochheim on the services rendered to science by Guericke and other distinguished physicists.

The formal work of the meeting was opened with a paper by Prof. Rosenbach of Göttingen, on the microscopic organisms present in festering wounds. After a brief reference to the discoveries of Koch and Ogston, the author dwelt upon his own investigations, by which he claims to have proved that all purulent matter is primarily due to minute animal organisms. The

most widespread of these germs is a yellow micrococcus, which, owing to its bunchy disposition when seen under the microscope, he has called the "grape coccus." It displays great vitality, and even after twenty or thirty years may give rise to rheumatic affections of the bones and joints. Another common species is the "chain coccus," consisting of small granular bodies strung together and presenting the appearance of chains or wreaths (Pasteur's "*chapelets*").

Owing to the colonial policy at present agitating German political and commercial circles, great interest was taken in a paper by the African explorer, Gerhard Rohlfs, on the position of Africa with regard to Germany. It contained an historic sketch of the relations of Germany with the Dark Continent, recommended the establishment of factories or trading stations in favourable places, but uttered a warning note against any premature scheme of emigration to Africa.

The second general session opened with a memoir by Prof. Braun on the Island of Yesso and its inhabitants, dealing with its geographical features, the character and social usages of its Aino aborigines, and concluding with an expression of confident assurance that sooner or later Yesso must be drawn within the sphere of European culture. Some remarks followed by Dr. Huyssen of Halle on the deep borings in the North German lowlands. A sketch was given of the borings executed since 1868 at the expense of the Prussian Government, with special reference to the results obtained in the gypsum formations at Sperenberg, twenty miles south of Berlin. Here a bed of rock-salt was met at a depth of 283 feet, through which the boring was continued down to 4051⅝ feet without reaching the bottom of the deposit. An account was given of the new method of boring, by which it became possible to sink a shaft to a depth corresponding to the height of the Brocken in the Hartz Mountains. The thermometric observations made in connection with these operations were stated to have fully confirmed previous views regarding the increased rate of temperature from the surface downwards.

Universal attention was attracted by the essay of Dr. Kirchhoff of Halle on "Darwinism and Racial Evolution," in which it was argued that the physical development of peoples was intimately dependent on the natural conditions of their respective surroundings. The inhabitants of northern lands are noted for a preponderance of the pulmonary functions; those of hot, moist, tropical regions for a more marked activity of the liver. Thus the strongest lungs prevail amongst the Mexicans, Peruvians, and Tibetans, who occupy the three highest plateaus on the surface of the globe. That adaptation to the environment is a question, not of "predestined harmony," but of natural selection, is shown by the evolution of the negro, the most perfect type of tropical man, who is found only in the Dark Continent. The daily pursuits of a people are, on the other hand, constantly evoking special organic peculiarities. This is shown most clearly in the keen sense of smell, sight, and hearing observed in all hunting and pastoral tribes of the highlands and steppe-lands, as well as in the sense of locality, and the surprising physical endurance under hunger, thirst, and other privations. Sexual selection, again, operates in the development of the body—head, hair, beard, and the like; in the style of dress and love of ornament; and lastly, in the formation of the national character, valour and ferocity being mainly conditioned in the savage, the economic and domestic virtues in civilised man, by the choice of partners in life, and the rejection of unqualified wooers in the "matrimonial market." But, apart from this consideration, the principle of selection prevails in the moral as well as in the physical order. As mankind pressed northwards, irrepressible spirits alone could sustain life under the depressing influences of bleak, Arctic surroundings. Hence the remarkably cheerful temperament of the Eskimo, who are also bred to peaceful habits, for peacefully-disposed families alone could dwell under a common roof, as the Eskimo are fain to do in the total absence of fuel. Through over-population the Chinese have become the most frugal and industrious of peoples, in recent times emigrating to foreign lands and crowding out all more indolent or pretentious races. In the international struggle for existence physical and moral superiority must always tell in the long run.

Even greater interest was taken in Prof. Finkler's paper, read with demonstrations on the bacillus of cholera and its culture. An outbreak of this epidemic last July at Bonn gave Prof. Finkler and Dr. Prior an opportunity of applying Koch's method to the study of the comma-shaped bacillus, which showed a remarkable resemblance to that of Asiatic cholera cultivated by Koch. It was found associated with large masses of the spiral-shaped organism, but with no other germ of specific appearance. These forms could not be detected in preparations of normal or any other pathological excreta under the same method of treatment. But after several failures a comma bacillus was obtained, which in its nourishment, period of evolution, and temperature behaved exactly like corresponding cultures obtained by Koch from true cholera. Still differences occurred in respect of the successive stages of evolution, which inferentially affects the question of the permanent form of the germs. After some time they become thicker, and assume somewhat the form of a whetstone, while at both extremities spore-like forms make their appearance, and take the shape of spore-bearers. Both spores are presently extruded from the spore-bearers, and begin to crawl about under the microscope. They assume the form first of straight, then of crooked rods, which develop into spirals of diverse shape, length, and curvature. Becoming thicker and swollen, these spirals in their final evolution seem to consist exclusively of small comma bacilli. But whereas the comma of Asiatic cholera, at least according to Koch's investigations, develops no permanent form, these acquire a stability in the spore state capable of resisting the process of putrefaction. Their behaviour, however, when being desiccated or subjected to chemical agents has not yet been tested by Prof. Finkler. Between the prepared specimens of cholera nostras and true cholera bacilli exhibited under the microscope no optical difference could be detected. Owing to the attitude of most German physicians, who regard it as a patriotic duty to hold Koch's doctrine as unassailable, while the German scientific journals persistently ignore the objections urged by eminent foreign investigators against the theory, Prof. Finkler's statements naturally excited considerable sensation, giving rise to an animated discussion, without however arriving at any positive results. In any case a severe blow was given to the assumption of Koch's infallibility, although Prof. Finkler and Dr. Prior have so far failed to determine the true pathogenetic and pathognostic functions of their cholera nostras comma bacillus, as completely as Koch has for his Asiatic cholera comma bacillus.

In the Section devoted to Mathematics, Astronomy, and Geodesy, Dr. Spörer of Potsdam discoursed on the determination of the elements of rotation in the sun, and on the origin of the solar spots. The theory was advocated of currents setting steadily towards the surface of the sun both from within and without.

Discussing the subject of comets' tails, Dr. A. Marcuse of Berlin assumed that the sun acted like an electro-magnet, and that the normal tails of comets consisted of diamagnetic material (carburets of hydrogen), whereas the abnormal tails, that is, those directed towards the sun, consisted of paramagnetic materials, such as iron.

In the Physical Section papers were read by Prof. Knoblauch of Halle on two fresh attempts to determine the angle of polarisation of metals; by Prof. Overbeck of Halle on galvanic polarisation; by Prof. Ostwald on galvanic resistance, dividing the acids in relation to the velocity of electrolytico-chemical reaction into three sharply separated groups according as they are uni-, bi-, or tri-basic; by Prof. Spörer on eruptions breaking through the nucleus of a solar spot; and by Prof. Recknagel on atmospheric resistance, arguing against Lössel that it increases with the size of the plates when these are circular.

The Meteorological Section, coinciding with the annual meeting of the German Meteorological Society under the presidency of Prof. Neumayer, was unusually well attended. Amongst the foreign honorary members elected on this occasion were Prof. W. Ferrel of Washington, Prof. H. Mohn of Christiania, and Prof. H. Wild of St. Petersburg. In his address on the development of meteorology and its importance to the State and society, Prof. Neumayer dwelt especially on the influence of Dove, Sabine, and other investigators, as well as of the various Polar expeditions and of the British Association on the general advancement of meteorological studies. In a second discourse he referred to the importance of synoptic studies in the South Atlantic Ocean, pointing to the results already obtained from observations taken in high southern latitudes, and urging the necessity of further investigation in the same regions.

Dr. Köppen of Hamburg followed with a paper on the principles determining the distribution of meteorological stations. Discussing the question of atmospheric electricity and lightning, Dr. E. Hoppe of Hamburg argued that the ascent of a warm atmospheric current must give rise to a thunderstorm as soon as it acquires sufficient velocity to prevent the equilibrium of the

electric current generated through the condensation produced by friction. Prof. Kiessling of Hamburg made some remarks on the diffraction colours in artificially-produced fog and their connection with the recent crepuscular phenomena. In the same department papers were submitted by Dr. Münter of Herford, on the cause of winds, and by Dr. Köppen of Hamburg, on barometric disturbances during storms.

In the Chemical Section the chief speakers were: Dr. Frank of Charlottenburg, on the past technical development of the alkali works at Stassfurt, where, in July 1882, 20,000,000 cwts. of carnallite were consumed in the preparation of chloride of potassium; Prof. Poleck and Dr. T. Schiff of Breslau, on the essential oil of *Sassafras officinalis*, Neer; Prof. Poleck, on talapin; Dr. Arrhenius, on the conductive force of the electrolyte; Prof. C. Willörodt of Friburg (Baden), a contribution to the study of acetonbromoform and acetonchloroform; Prof. E. Lippmann, on a new method of representing oxygenous compounds; Dr. Leuckart of Göttingen, on a synthesis of aromatic monocarbon acids, dealing with the reciprocal action of aromatic carburets of hydrogen and cyanates in the presence of chloride of aluminium.

In the Geological and Mineralogical Section papers were read by Prof. Lossen of Berlin on the peculiar features of the geology of the Hartz Mountains; by Prof. von Fritsch of Halle on the Cretaceous floras of the Hartz; by Prof. Nehring on the diluvial fauna of the province of Sachsen and conterminous districts; by Dr. Wahnschaffe of Berlin on the Quaternary formations in the neighbourhood of Magdeburg; by Engineer Petsch of Aschersleben on the subsidence of underground waters during the process of freezing.

In the Botanical Section Prof. E. C. Hansen of Copenhagen described some new researches on certain fungi of vinous fermentation found in cow-dung and on sweet succulent fruits; A. Zimmermann, on the action of the optical elastic ellipsoid of vegetable tissues in the process of expansion: from a study of the tissues of *Nitella flexilis* and some other plants, the author concluded against Noegeli that in optical respects no fundamental contrast exists between organic and inorganic substances; W. Detmer on the formation of muriatic acid in plants; Prof. Soraner on the action of artificial freezing, describing the conduct of various vegetable tissues under the freezing process; Dr. Kaiser on the results of the determination of fossil leafy plants.

In the Section for Zoology and Comparative Anatomy, Prof. Landois of Münster spoke on the development of the shell of certain birds' eggs; Dr. H. F. Kessler of Cassel, on the evolution and life-history of the blood parasite, *Schizoneura lanigera*, Hausm.; Prof. Nehring of Berlin, on the skull and skeleton of the Peruvian dogs from the Necropolis of Ancon, with remarks on their origin: on the ground of his comparative studies, the author inferred that these dogs must have sprung from some variety of the North American wolf (*Lupus occidentalis*); Dr. Müllendorf of Berlin, on the importance of the formic acid found in honey: when closing the cells of the honeycomb, the bees mix the honey with formic acid in order to give it greater consistency; Prof. Leuckart of Leipzig, on a new species of Nematode found in the body of *Hylobius pici*, 3 mm. long, 1 mm. thick, and named *Allantiema mirabile*; Prof. W. Blasius, on some fresh data in connection with the remains of *Alca impennis*, Linn.

The excursions with which the proceedings were diversified included visits to the model Meteorological Observatory of the Magdeburg Zeitung, to the neighbouring chemical works of Stassfurt, to the University of Halle, and to the Hartz Mountains.

It was announced that the Association would hold its next annual meeting at Strasburg.

SCIENTIFIC SERIALS

Journal of the Franklin Institute, No. 3, September 1884.—Synchronous-multiplex telegraphy in actual practice, by Prof. Edwin J. Houston (illustrated).—An extraordinary experiment in synchronous-multiplex telegraphy, by Prof. Edwin J. Houston.—On the application of electricity as an illuminating agent in astronomical observatories, by W. S. Franks.—A metastatic heat regulator, by N. A. Randolph, M.D. (one figure).—The drying of gunpowder magazines, by Prof. C. E. Munroe, U.S.N.A.—On an explanation of Hall's phenomenon, by Shelford Bidwell, M.A., LL.B. (table).—Instruction in mechanical engineering, by Prof. R. H. Thurston.—Report on the trial of the "City of Fall River," by J. E. Sague, M.E., and J. B. Adger, M.E. (concluded from p. 115) (tables and diagrams).—Report of the Board of Experts on Street-paving (tables).—Surveys for the future water-supply of Philadelphia, by Rupert Hering, C.E. (tables).—Methods in physical astronomy.—Solar motor and solar temperature.—Hirn's actinometer.—Soap-roots.—Aluminium and aluminium-bronze.—Palmieri's atmospheric electricity.—New electro-magnet.—Tanning by electricity.—Gases in steel.—The volcanic ashes of Krakatoa.—Papal Observatory.—Origin of volcanic activity.—Balloon photography.

Verhandlungen des naturhistorischen Vereins der Rheinlande und Westfalens, January–June.—Report on the proceedings of the Society during the year 1883.—On the recent chalk and diluvium formations of the Mülheim district, by Dr. Deicke.—On the disposition of the stratified rocks and lias in the neighbourhood of Herford, by H. Monke.—Report on the fossils of the greensand rocks in the district of Aix-la-Chapelle, by J. Böhm.—On the fishes, crustaceans, and flora of the Upper Chalk system in Westphalia, by Dr. Marck.—On the digestive organs of the spider, by Prof. Bertkau.—On the human skull found associated with the mammoth, rhinoceros, and reindeer in the loess of Podbaba near Prague, by Prof. Schaffhausen.—On some fossil remains from the Devonian rocks of Eifel, by Prof. Schlüter.—A contribution to the physiology and anatomy of *Dasypoda hirtipes* (two plates), by Dr. Hermann Müller.—On the diorite of the Upper Ruhr Valley and its association with the argillaceous schist of the same district, by Dr. A. Schenck.—On the causes of the great oscillations and disturbances in the crust of the earth, by F. F. von Dücker.—On the occurrence of fossil wood in the region of the Westphalian Coal-Measures, by W. Wedekind.—On the mutual relations of the Middle Eocene formations of Monte Postale, Ronca, and San Giovanni Ilarione, by Dr. H. Rauff.

Rendiconti del R. Istituto Lombardo, July 31.—Some reflections on the proposed laws for regulating the administration of public and private lunatic asylums in Italy, by Dr. C. Zucchi.—Various researches on the Bacillus of tuberculosis, by Prof. Giuseppe Sormani.—Description of a continuous registrar of electric energy transmitted at any given point of a circuit, by Prof. R. Ferrini.—On the geometrical surface of the third order, by Prof. E. Bertini.—Remarks on the Turin Gloss on the Institutions and Paraphrase of Pseudotheophilus, by Prof. C. Ferrini.—Meteorological observations made at the Brera Observatory, Milan, during the month of July 1884.

Rivista Scientifico-Industriale, August 15.—Results of experiments on the variations of electric resistance of argentan wire subject to tension, by Dr. Sebastiano L. Angelini.—Experiments on the compressibility of fluids, and especially of water, by Prof. Pagliani and Dr. S. Vicentini.—Observations on the struggle for existence between *Staphylinus olens* and *Lumbricus agricola*, by Silvio Calloni.

August 30.—Description of a universal anemometrograph (wind-gauge) recently invented by Prof. Michele Cagnassi.—Remarks on an elementary demonstration relating to the theory of the potential, by Giuseppe Vanni.—Remarks on the variations in the electric resistance of solid and pure metal wires under changes of temperature, by Prof. Angelo Emo.

Bulletin de la Société des Naturalistes de Moscou, 1883, No. 4.—On the seeming anomalies in the structure of the great comet of 1744, by Th. Bredichin (in French), with plates. It appears from calculations, illustrated by a plate, that the strips observed on this comet correspond to the "synchronal" curves of the author deduced in the hypothesis of repulsive force.—Some remarks on comets, by the same. The initial speed of their appendages towards the sun is approximately deduced at 2000 m. per second.—On the tail of the first type of the comet 1858 V., by A. Sokoloff (in French), being a calculation of "syndynamic" curves according to Bredichin's method.—On *Cæsona pinitorquum*, A. Br., by Ed. Kern (in German), with 4 plates.—Remarks on the geological map of the Vetluga region, by H. Trautschold.—A new Pleurotoma (*Renardii*) from the Miocene of Italy, by De Gregorio.—A new demonstration of the theorem of Lambert, by N. Joukovsky (in French); it is based on the formula of variation of action.—Materials for the geology of the Crimea, by W. Sokoloff (in Russian), being notes on the Jurassic and Neocomian deposits in the neighbourhood of Simferopol.—On the recent work of the United States geologists, by H. Trautschold.—Letter from Dr. Regel, from Tashkend.